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INTRODUCTION

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A. Background

On March 10, 1983, the National Machine Tool Builders' Association (NMTBA) of McLean, Virginia, petitioned the Secretary of Commerce to conduct an investigation to determine the effect on the national security of imports of metalworking machine tools pursuant to Section 232 of the Trade Expansion Act of 1962, as amended (Title 19 U.S. Code 1862) (the Act). The Act states that:

"The Secretary shall report the findings of his investigation...with respect to the effect of the importation of such article...The President shall take such action, and for such time, as he deems necessary to adjust the imports of such article...so that such imports will not threaten to impair the national security...."

In its petition, the NMTBA asserts that current import trends of metalworking machine tools will result in a critically weakened industry which will be incapable of providing an adequate supply of machine tools during a national emergency. The petitioner requests a five year regime of quotas on imports in each of the two broad-based sectors of machine tools. The petition focuses on imports of new metal-cutting type and metal-forming type machine tools which are described by Standard Industrial Classification (SIC) Codes 3541 and 3542, and by the Tariff Schedules of the United States Annotated (1983) (TSUSA) items 674.1010 and 674.3025 through 674.3599, excluding TSUSA classifications for used or rebuilt equipment and equipment valued at less than \$2,500'.

The petitioner requests that imports of the two general categories of machine tools--metal-cutting and metal-forming --be limited to 17.5 percent of annual domestic consumption, with imports of each type of machine tool within those two general categories not to exceed 20 percent of consumption.

The Department of Commerce reviewed and accepted the petition and initiated its investigation on March 14, 1983. Notice was published in the Federal Register (48 FR 15174) on April 7, 1983, advising the public that an investigation was being conducted and inviting interested parties to submit written comments. A summary of the petition, a copy of the Federal Register notice accepting the petition, Section 232 of the Trade Expansion Act, and the implementing regulations are included in the Appendix.

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B. Methodology of the Investigation

The investigation focuses on the effects of machine tool imports on the U.S. ability to meet defense and essential civilian requirements during a mobilization. It was conducted by the Department of Commerce (DOC) in consultation with the Departments of Defense (DOD), State, Labor, Treasury, Energy (DOE), Justice, Transportation, the Council of Economic Advisors, the Federal Emergency Management Agency (FEMA), the Office of the United States Trade Representative, the International Trade Commission (ITC), and the Central Intelligence Agency (CIA). This investigation made maximum use of existing reports and previous studies by both the U.S. Government and the private sector. Individual agency contributions to the investigation are noted throughout the report as appropriate.

The Department of Commerce regulations governing Section 232 provide the following factors for consideration in determining the effects of imports on the national security:

- (a) requirements of the direct defense, indirect defense, and essential civilian sectors of the national economy;
- (b) domestic production needed for projected national defense needs;
- (c) capacity of domestic industries to meet projected national defense needs;
- (d) existing and anticipated availability of labor (skilled and unskilled), raw materials, production equipment and facilities, and other supplies and services essential to the national defense;
- (e) growth requirements of domestic industries to meet national defense requirements;
- (f) quantity, quality and availability of imports;
- (g) impact of foreign competition on the economic welfare of the essential domestic industry;
- (h) serious effects of imports resulting in the possible displacement of domestic products, unemployment, decrease in revenues to the government, loss of investments, loss of specialized skills and loss of productive capacity;
- (i) any other relevant factors that may weaken the national economy; and

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(j) other factors relevant to the national security in light of any unique circumstances associated with each case.

Multistep Review

After assessing the significance of the above noted factors, the Department followed a two-step procedure to reach findings for each category of machine tool under investigation: 1) machine tool requirements for a three year war, preceded by a one year mobilization, were compared with the anticipated total available supply from domestic production, inventories and reliable foreign suppliers; 2) in those cases in which direct defense, indirect defense, and civilian requirements could not be met by a combination of domestic production, inventories and reliable foreign supplies, an analysis was made to determine whether a threat to national security is due to imports.

In making a finding regarding the impact of imports on national security, the Department of Commerce evaluated the: 1) changing market patterns for each type of tool, 2) changes in domestic production and production capacity for each product, 3) increased reliance on imports, 4) reliability of imported supply sources in an emergency, and 5) limitations to industry growth and low capacity utilization of domestic production facilities. To find that imports of machine tools pose a threat to national security, it is necessary to determine that the shortfall of anticipated supply to mobilization requirements is the direct result of a declining domestic production base, or limitation on expanding domestic production capacity, resulting from import penetration.

The investigation begins with a description of the machine tool industry and the products under review as identified by the petitioner. This is followed by an assessment of the domestic industry's ability to compete with foreign producers for a share of the U.S. and world markets on the basis of product quality, delivery, service and price. The impact of programs and regulations administered by the Federal Government on the machine tool industry is also discussed. Recent market trends are identified, with an emphasis on imports. A national security assessment follows to determine whether domestic capacity, supplemented by reliable imports, is sufficient to meet the requirements of the U.S. economy during a national emergency. The investigation concludes with a summary and individual product findings as to whether imports threaten to impair the national security.

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1. The tariff schedule for machine tools is included in the Appendix to this investigation.

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NATURE OF THE INDUSTRY

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The following describes the U.S. machine tool industry. The eighteen categories of machine tools subject to the investigation are also described.

A. Industry Description

-The Bureau of the Census publication, 1977 Census of Manufacturers, reports that the U.S. metalworking machine tool industry is comprised of 1,343 firms employing approximately 65,700 workers. However, approximately 40% of the establishments reported to be machine tool builders by Bureau of the Census were actually manufacturers of machine tool accessories, dies, fixtures, etc. -- not builders of complete machine tools.¹ The DOC's Bureau of Industrial Economics estimates the number of establishments currently producing machine tools at 600, with Labor Department estimates of the number employed as production workers at 36,900 as of the second quarter of 1983. A fuller discussion, provided by the Department of Labor, on employment in the U.S. machine tool industry is located in the Appendix.

Approximately 40 U.S. firms have overseas production facilities and some foreign firms have opened factories in the U.S.² Licensing agreements have also been made with foreign firms on specific products, and joint ventures are prevalent.³

Economic Factors

The dominant characteristic of the machine tool industry is its sensitivity to cyclical changes in the economy. When the economy expands, the subsequent demand for machine tools occurs later, is sharper, and is of shorter duration than the demand-pull experienced by other industries. And when the economy contracts, orders decline much more rapidly for machine tools than for other durable goods.⁴ Figure II-1 depicts the severe swings in machine tool orders.

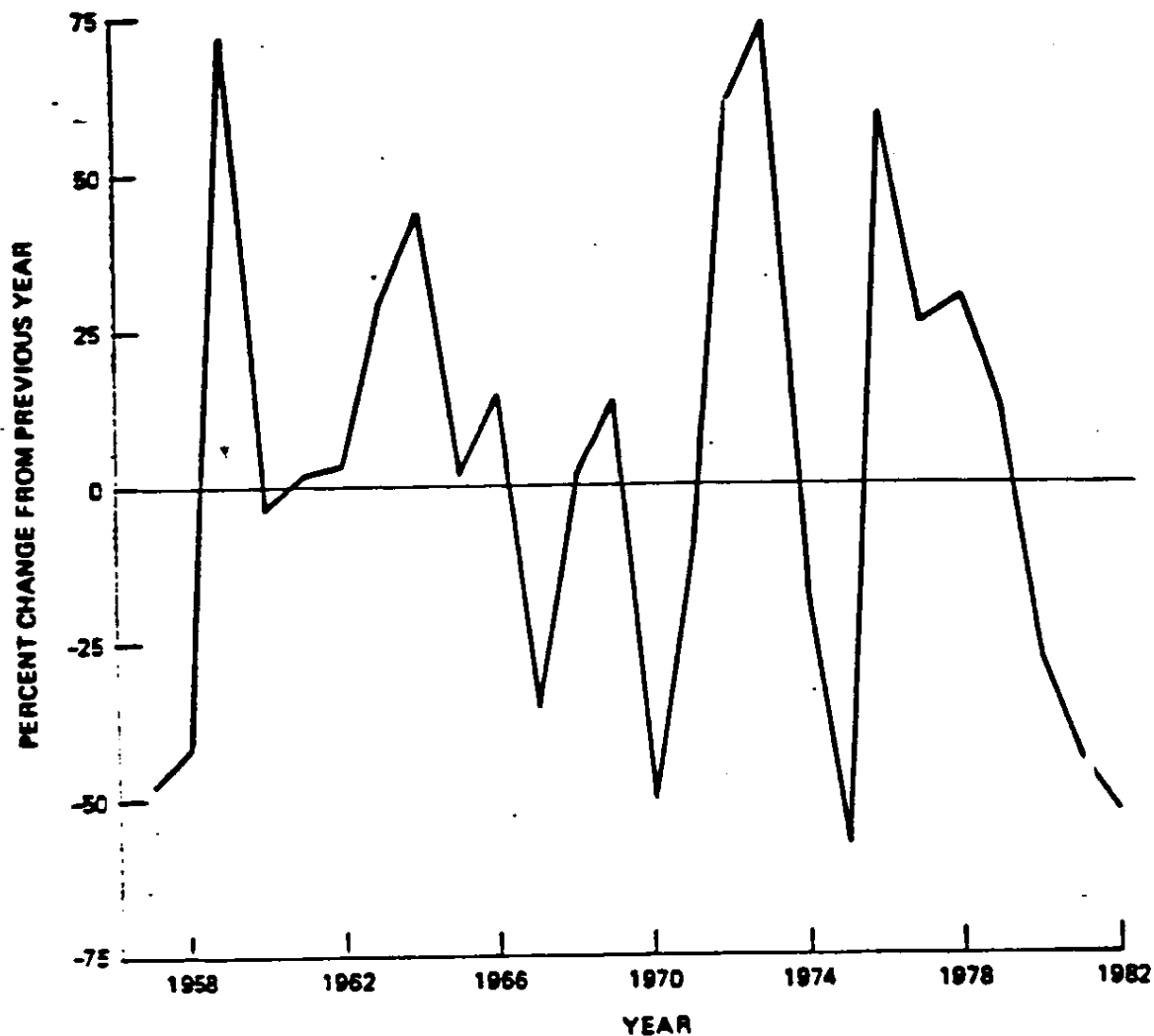
In response to this cyclical trend, management in the machine tool industry has favored the build-up of order backlogs when demand surges, as a means of ensuring that production will continue when demand drops.⁵ While this approach accommodates the troughs in the industry's business cycle, by sustaining production in an otherwise slow market, it does not allow for timely industry response to periods of peak demand, when machine tool purchasers are anxious to acquire additional machine tools to meet peak demand for products in their own markets.⁶

The condition of the industry can best be described further by examining the following four economic indicators: capacity utilization, employment, profitability, and capital investment.

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Year-to-Year Change in Real Net New Orders of Machine Tools 1957-82



Sources: NMTBA, Economic Handbook of the Machine Tool Industry, 1982-82, and NMTBA, "Industry Estimate of New Orders, Cancellations, Shipments and Backlog (monthly)"

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1. Capacity Utilization

Historically, capacity utilization rates have fluctuated dramatically in response to the industry's business cycle. According to an International Trade Commission survey conducted in 1983, capacity utilization in the U.S. machine tool industry increased from 69% in 1977 to 76% in 1979, and dropped to 36% by the end of 1982. In the same survey, respondents indicated that the capacity to produce metal-working machine tools increased 15% from 1977 to 1982, primarily through the expansion of facilities and purchase of new equipment.⁷ The petitioner projects that due to large domestic inventories of foreign machine tools, the capacity utilization rate for the domestic machine tool industry will increase more slowly in the next phase of the business cycle. The petitioner anticipates that new orders will be filled from available stocks first, with any increase in actual production to lag well behind any future increase in demand.⁸

2. Employment

According to the Department of Labor, employment in the machine tool industry increased in tandem with increased domestic shipments in the years 1979-1980. In 1979 the number of machine tool workers employed in the industry was 68,900 and increased to 71,700 in 1980. However in 1981, employment began to decline, dropping to 67,300 in that year to a low of 51,300 in 1982--a 28% decrease from the employment level of 1980. First and second quarter 1983 employment data (latest available) indicate further substantial declines. The unemployment rate in the machine tool industry at present varies from 4% to 21.4% across the 241 machine tool labor market areas.

The 1982 distribution of production workers in the industry between the metal-cutting and metal-forming sectors was 38,800 in the former and 12,500 in the latter category. By the second quarter of 1983, employment declined to 27,400 workers in the metal-cutting sector and 9,500 in the metal-forming sector. Although efforts are being made to retain the critical and more highly skilled workers, additional layoffs are anticipated.

Despite the downturn in employment in the period, hourly earnings for workers in the machine tool industry increased slightly during the 1980-82 period. Hourly earnings for both sectors averaged \$9.88 in 1982. This compares to \$8.50 for all manufacturing in 1982. In April 1983, the averages were \$10.17 in machine tools and \$8.77 for all other manufacturing.

Analysis of job and skill proficiency information indicates that under varying job titles, eight critical jobs exist in the

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machine tool industry: tool maker, machinist, machine tool builder/assembler, test technician, manufacturing engineer, computer engineer, electrical engineer and mechanical engineer. The first three of these are unique to the machine tool industry. Minimum on the job training and/or experience required in all eight of these occupations is 1-3 years as a test technician to a maximum of 4-10 years for a tool maker. An optimum proficiency level is achieved in a minimum of 3-5 years for electrical or computer engineers and 10-14 years for a tool maker. The industry reportedly makes efforts to retain its workforce during downturns to prevent aggravating the industry's shortages of highly trained skilled workers when business increases. Machine tool companies and trade unions queried by the Department of Labor contend that current economic conditions make it unlikely that those workers who are displaced from the industry will find new, related employment which would permit them to retain skills critical to the machine tool industry.

According to the Department of Labor, while there are no other industries directly related or comparable to the machine tool industry, some labor could be shifted from the aerospace, electronics, and heavy electrical equipment industries to the production of machine tools during an emergency. However, such conversions would be time-consuming as such displaced workers would require extensive training, which would be difficult to accomplish during a mobilization. Furthermore, the very industries providing labor comparability would also be tasked to maximize production in a mobilization effort. Thus, essentially no fungibility exists in the transfer of labor between industries which could assist the machine tool industry in meeting increased production requirements pursuant to the mobilization scenario.

3. Profitability

The industry maintained a moderately healthy level of profit relative to sales and net worth in the years 1975 through 1981, despite the effects of the industry's business cycle.⁹ Table II-1 compares the profitability of the industry as a whole to other U.S. durable goods manufacturers for that period. Profit levels for the machine tool industry exceeded those for all durable goods industries for four of the seven years shown. However, it has been estimated that the machine tool industry incurred losses in 1983 for the first time since 1971-1972.¹⁰

4. Capital Investment

Capital investment has taken place at a lesser rate in the machine tool industry than in other U.S. industries. The profitability of the machine tool industry has been cyclical,

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**Selected Financial Ratios Comparing U.S. Machine Tool
Industry with Durable Goods Manufacturers**

Year	Machine Tool Industry		Durable Goods Industry		Comparisons	
	a.	b.	c.	d.	e.	f.
	Net Operating Profit on Sales	Earnings on Net Worth After Taxes	Net Operating Profit on Sales	Earnings on Net Worth After Taxes	column "a" as % of column "c"	column "b" as % of column "d"
1975	9.1	13.8	6.7	9.9	135.8	139.3
1976	9.4	11.0	7.9	13.6	118.9	80.8
1977	7.6	12.3	8.2	14.5	92.6	84.8
1978	7.8	12.8	8.5	15.9	91.7	80.5
1979	12.2	16.3	7.6	15.5	160.5	105.1
1980	13.1	18.1	6.0	11.2	218.3	161.6
1981	12.6	18.0	6.5	12.0	193.8	150.0
1975-81 averages	10.25	14.61	7.34	13.22	144.51	114.58

Sources: Federal Trade Commission; NMTEA.

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and it appears that financial institutions have been hesitant to invest in an industry where the rate of return on investment may be cyclical as well. Instead of making major capital investments, the machine tool industry generally uses capital generated during demand peaks to retain as many skilled workers as possible during those periods when demand and profitability are declining.¹¹

Table II-2 shows the level of new capital expenditures in the domestic machine tool industry compared to that of other U.S. industries. As shown in that table, the level of new capital expenditures as a percent of the value of shipments in the machine tool industry was generally below that for comparable industries from 1975-1980.

B. Product Descriptions

Machine tools are used to create almost all manufactured products--from roller skates to airplane parts--either directly or by producing the machine that will make the products. Metal-working machine tools, as opposed to wood-working or other types, constitute the bulk of machine tools produced and consumed in the industrialized world.¹²

Metal-working machine tools are of two general types; metal-cutting or removing and metal-forming. Metal-cutting machine tools include those used for boring, drilling, gear cutting and finishing, grinding, polishing, etc., and are the most numerous, comprising about 75% of new shipments by volume. Metal-forming machine tools include machines used for punching, pressing, shearing, bending, etc., and comprise the remaining 25% of new shipments.¹³

Although machine tools have changed little with respect to their basic functions of cutting and forming metal, the way such machines are controlled has changed with advances in electronic and computer technology. Early machine tools were manually operated. Now various control mechanisms are available which provide a cost effective means of increasing production. Numerically controlled (NC), programmable control (PC), direct numerical control (DNC), and computer numerical control (CNC) machine tools offer increases in productivity through decreased costs and through increased machine utilization. These technological advances increase one's ability to manufacture more than one product or provide the opportunity to change the sequence of producing such products. They can also provide automated information retrieval on machine tool utilization.¹⁴

Computer controlled machine tools are also playing a major role in the development of flexible manufacturing systems (FMS), the latest major innovation in the use of machine tools. A FMS system is a

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Table II-2

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New Capital Expenditures
as a Percent of the Value of Shipments—Selected Industries,
1975-1980

Industry	Percent
Miscellaneous Machinery (SIC 359)	5.9
Office Machinery (SIC 357)	5.5
Blast Furnaces/Basic Steel Products (SIC 331)	4.6
Construction Machinery (SIC 353)	4.0
General Industrial Machinery (SIC 356)	3.5
Engines and Turbines (SIC 351)	3.4
Motor Vehicles and Equipment (SIC 371)	3.4
Farm Machinery (SIC 352)	3.1
MACHINE TOOLS (SIC 3541 AND 3542)	2.9
Special Industrial Machinery (SIC 355)	2.9
Refrigeration and Service Machinery (SIC 358)	2.5

Source: Based on data from the Annual Survey of Manufactures and the
1977 Census of Manufacturers.

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fully automated production system capable of the batch processing of different but similar parts simultaneously and interchangeably.¹³

The categories of machine tools subject to this investigation are briefly described below.

1. Metal-Cutting

Boring Machines - cut cylindrically into a metal from either a horizontal or vertical angle.

Drilling Machines - cut round holes of various sizes into materials where bolts, screws and threads are to be fitted.

Gear Cutting Machines - cut teeth into metals and are used for making various kinds of machine gears.

Grinding and Polishing Machines - smooth a surface by means of grinding stones, wheels, abrasives or polishing products.

Lathes, including Numerically-Controlled - cut a workpiece to shape by a turning process.

Milling Machines - use rotating cutters to produce flat or formed surfaces.

Machining Centers - numerically controlled machines that perform multiple operations (boring, drilling, milling) sequentially on the same piece of material.

Station Type Machines - include way, rotary or transfer type machines, which mechanically transfer material from one machining station to another to perform multiple machining operations in high volume applications.

Other Metal Cutting Machines - used for tapping, chamfering, shaving, grooving, etc.

2. Metal-Forming

Punching and Shearing Machines including Numerically-Controlled - produce holes, notches and slots of different shapes in sheet and strip metal; and produce outside part configurations from sheet and strip metal.

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Bending and Forming Machines including Numerically-Controlled - form metal sheets, tubing, bars or angles into shapes under pressure.

Presses - used to straighten or shape metal plate, bar and rod or other shapes under pressure through the use of dies.

Forging Machines - used to produce primary metal shapes from metal stock under pressure which normally require further machining.

Other Metal-Forming Machines - include thread-rolling machinery, riveting and metal-container making machines.

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NOTES TO CHAPTER II

1. 1977 Census of Manufacturers, Bureau of the Census, Department of Commerce, Volume II, Industry Statistics, Part 3, SIC Major Groups 35-39, U.S. Government Printing Office, Washington, D.C. 20402, August 1981, p. 35 C-7.
2. "The U.S. Machine Tool Industry and the Defense Industrial Base," Committee on the Machine Tool Industry Phase II, Manufacturing Studies Board, Commission on Engineering and Technical Systems, National Research Council (NRC), National Academy Press, Washington, D.C., 1983, pre-publication copy, p.5.
3. NRC, p.63
4. "A Competitive Assessment of Flexible Manufacturing Systems," Draft Report, Office of Competitive Assessment (OCA), Office of Productivity, Technology and Innovation, Department of Commerce, September 1983, p.16.
5. NRC, p.15.
6. NRC, pp. 38-40.
7. "Competitive Assessment of the U.S. Metalworking Machine Tool Industry", Report to the United States International Trade Commission (ITC) on Investigation No. 332-149 under Section 332 of the Tariff Act of 1930, USITC Publication 1428, Washington, D.C., September 1983, p.x.
8. "Petition under the National Security Clause, Section 232 of the Trade Expansion Act of 1962 (19 U.S.C. Sec.1862), For Adjustment of Imports of Machine Tools," submitted to the Department of Commerce by the National Machine Tool Builders' Association on March 10, 1983, pp. 153-155.
9. NRC, pp.17-18.
10. OAC, p.20.
11. ITC, p.99.
12. ITC, p.1.

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13. "Capital Formation and Imports in the U.S. Machine Tool Industry," Donald Dalton, Bureau of Industrial Economics, Department of Commerce, September 1981, p.5.

14. ITC, p.2.

15. OCA, p.5.

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